(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号

特開平7－7072

(43)公開日　平成７年(1995)１月10日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｈ０１Ｌ　21/68	Ｒ			
	Ｎ			
Ｂ２３Ｑ　3/15	Ｄ	8612－3C		
Ｃ２３Ｃ　14/50	Ａ	0827－4K		
Ｈ０２Ｎ　13/00	Ｄ	8525－5H		

審査請求　未請求　請求項の数４　ＯＬ　（全４頁）

(21)出願番号　特願平5－146487

(22)出願日　平成５年(1993)６月17日

(71)出願人　000227294
日電アネルバ株式会社
東京都府中市四谷５丁目８番１号

(72)発明者　土井　浩志
東京都府中市四谷５丁目８番１号　日電アネルバ株式会社内

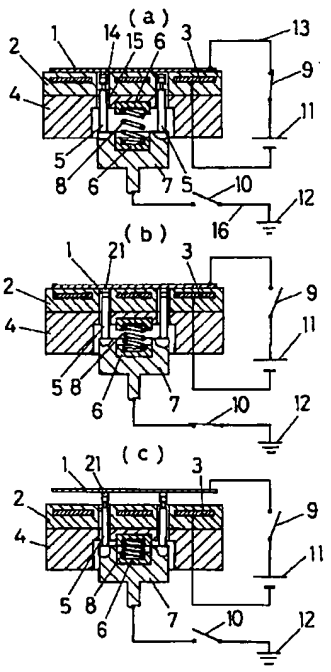
(74)代理人　弁理士　鈴木　正次

(54)【発明の名称】　静電チャック装置における基板の脱着方法および脱着機構

(57)【要約】

【目的】　半導体ウエハーなどの処理基板をプラズマ処理する装置で使用する静電チャック装置における基板の脱着方法および脱着機構に関する。処理基板を破損するおそれを無くすると共に、処理基板内の回路にダメージを与えないようにすることを目的としている。

【構成】　静電チャックの吸着面にリフトピン５を突出可能に設けてなる静電チャック装置の基板脱着機構において、リフトピン５は抵抗部材２１が介設してあると共に、長さ方向で伸縮可能としてある。処理基板１を脱着する際、リフトピン５を上昇させて、リフトピン５の先端を処理基板１の裏面に当接し、当接初期状態を一時的に保って、吸着面の静電気を抵抗部材２１を通して放電させ、然る後リフトピン５を再上昇させて基板１を吸着面から脱着させる。



1

【特許請求の範囲】

【請求項１】　静電チャックに吸着した基板をリフトピンの上昇を介して脱着する方法において、リフトピンを上昇させて、リフトピンの先端を基板の裏面に当接し、当接初期状態を一時的に保って、吸着面の静電気をリフトピンに介設した抵抗部材を通して放電させ、然る後リフトピンを再上昇させて基板を吸着面から脱着させることを特徴とする静電チャック装置における基板の脱着方法。

【請求項２】　静電チャックの吸着面にリフトピンを突出可能に設けてなる静電チャック装置の基板脱着機構において、前記リフトピンは抵抗部材が介設してあると共に、長さ方向で伸縮可能としてあることを特徴とする静電チャック装置の基板脱着機構。

【請求項３】　リフトピンは、先端側にバネを介して杆体を弾持し、該杆体の先端に抵抗部材を設けて構成した請求項２記載の静電チャック装置の基板脱着機構。

【請求項４】　抵抗部材は、杆体に着脱可能に設けてある請求項３記載の静電チャック装置の基板脱着機構。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、ドライエッチング装置、スパッタリング装置、プラズマＣＶＤ装置、その他のプラズマ処理装置の、基板支持部を構成する静電チャック装置に係り、静電チャック装置に吸着した基板の脱着方法および脱着機構に関する。

【０００２】

【従来の技術】従来、プラズマを利用して、半導体ウエハーなどの基板を処理する技術として、ドライエッチング法、スパッタリング法、プラズマＣＶＤ法などが知られている。

【０００３】これらの技術で基板の処理をする場合、プラズマに晒される基板の温度は２００℃前後に上昇するので、一般には、水その他の冷媒で冷却された基板ホルダーで支持し、基板が加熱されるのを防いでいる。

【０００４】前記基板ホルダーと基板は、冷却効果を確実に得る為に、両者間の熱伝導度を高くすることが必要で、クランプによって基板を基板ホルダーに圧接させる方法があったが、クランプ部分（基板の縁部）は処理から除外される為、基板の有効利用が妨げられることから、図３に示したような静電チャック装置が広く利用されるに至っている。

【０００５】図３に示した静電チャック装置は、処理基板３１を支持する基板ホルダーを構成するもので、絶縁物３２（以下の実施例も含めて、厚みをもって示してあるが、実際には数百ミクロンの厚さである。）で覆われた電極３３が冷却機構３４上に設けてある。スイッチ３９と直流電源４１（１～２Ｋｖ）を有する直流回路によって、処理基板３１と電極３３間に電位差を与えると、処理基板３１と電極３３の間に電荷が蓄積されて、静電吸着力が得られるものである。尚、リアクティブイオンエッチング装置の場合のように、プラズマ処理中のプラズマ電位と電極３３に印加した直流電圧によって、処理基板３１と電極３３間に電位差が生じるようにして、前記直流回路は使用しない場合もある。

2

【０００６】前記冷却機構３４側には、該冷却機構と絶縁物３２および電極３３を貫通して、処理基板３１側に突出できるようにしたリフトピン３５、３５が昇降機構３７を介して設けて基板の脱着機構が構成してある。昇降機構３７と冷却機構３４間にはバネ３８が設置してあり、リフトピン３５、３５は、先端部が絶縁物３２内に没入するようにされている。

【０００７】所定のプラズマ処理が終了した時に、昇降機構３７を介してリフトピン３５、３５を基板吸着面を越えて処理基板３１側に突出させると、リフトピン３５、３５が処理基板３１に当接して、静電チャック時に処理基板３１と電極３３間に蓄積された電荷をリフトピン３５、３５を通してアース側に放電させて、静電吸着力を解除し、処理基板３１が絶縁物３２から持上げられるようになっている。

【０００８】

【発明が解決しようとする課題】前記のような静電チャック装置において、リフトピン３５、３５を突出させて処理基板３１を持上げて脱着する場合、次のような問題点があった。

【０００９】即ち、前記の静電チャック装置において、リフトピン３５、３５が処理基板に当接してから、処理基板３１と電極３３の間に蓄積された電荷が放電されて、静電吸着力が無くなるまでには、極く短時間ではあるが、ある時間が必要であった。然し乍ら、リフトピン３５、３５は処理基板３１に当接した位置で止まることなく上昇するような構造であったので、静電吸着力が未だ残っているのに拘らず、処理基板３１を持上げることになり、残留している静電吸着力が大きい場合には、処理基板３１に無理な力が加えられ、処理基板３１を飛び出させたり、破損するおそれもあった。

【００１０】又、前記処理基板３１と電極３３間に蓄積した電荷をリフトピン３５、３５を介してアース側に放電する回路には、電流値を制限するものが無いので、放電々流は処理基板３１に最初に当接したリフトピン３５を通して無制限で急激に流れることになり、これが原因で、処理基板３１内に形成した回路（半導体デバイスとしての）にダメージを与えるおそれがあった。

【００１１】この発明はこのような問題点に鑑みてなされたもので、処理基板を破損するおそれを無くすると共に、処理基板内の回路にダメージを与えないようにした静電チャック装置における基板の脱着方法および脱着機構を提供することを目的としている。

【００１２】

【課題を解決する為の手段】上記の目的を達成するこの

発明の静電チャック装置における基板の脱着方法は、静電チャックに吸着した基板をリフトピンの上昇を介して脱着する方法において、リフトピンを上昇させて、リフトピンの先端を基板の裏面に当接し、当接初期状態を一時的に保って、吸着面の静電気をリフトピンに介設した抵抗部材を通して放電させ、然る後リフトピンを再上昇させて基板を吸着面から脱着させることを特徴としている。

【００１３】又、この発明の静電チャック装置における基板の脱着機構は、静電チャックの吸着面にリフトピンを突出可能に設けてなる静電チャック装置の基板脱着機構において、前記リフトピンは抵抗部材が介設してあると共に、長さ方向で伸縮可能としてあることを特徴としている。

【００１４】前記リフトピンは、例えば先端側にバネを介して杆体を弾持し、該杆体の先端に抵抗部材を設けて構成する。抵抗部材は杆体に対して着脱可能に設けるのが望ましい。

【００１５】

【作用】この発明によれば、リフトピンの先端を基板の裏面に当接させた初期状態を一時的に保つので、吸着した基板を無理に押上げることなく、吸着部の静電気を放電させることができる。従って、基板の飛び出しや破損を無くすることができる。

【００１６】又、静電気の放電は、リフトピンに介設した抵抗部材を通して行うので、放電々流が制限され、急激な放電々流による基板内の回路の破壊などのダメージを与えないようにできる。

【００１７】前記抵抗部材を着脱可能に構成した場合、放電回路の抵抗値を変化させて、放電々流を処理基板の構造等を考慮して設定することができる。

【００１８】

【実施例】以下、この発明の実施例を図を参照して説明する。

【００１９】図１において、(a) は実施例の静電チャック装置が処理基板１を静電吸着している状態、(b) はリフトピン５を上昇させて処理基板１と電極３の間に蓄積した電荷を放電している状態、(c) はリフトピン５で処理基板１を持上げた状態を、夫々表わしている。

【００２０】実施例の静電チャック装置は、図３に示した従来の装置と同様に、絶縁物２で覆われた電極３が冷却機構４に搭載して構成され、処理基板１と電極３の間に直流電圧を印加する為の回路１３がスイッチ９と直流電源１１により構成してある。

【００２１】絶縁物２および電極３を貫通するように形成した孔１４と、冷却機構４を貫通するように形成した孔１５が互いに連通させてあり、これらの孔１４、１５に挿通したリフトピン５、５が、冷却機構４の下部に設置した昇降機構７に植設して、基板の脱着機構が構成してある。昇降機構７と冷却機構４の間には、バネ８が絶

縁材製のバネ受け６、６を介して装着してあり、バネ８の弾力でリフトピン５、５は、先端部分が常時、絶縁物２内に位置し、絶縁物２の上側に突出しないようにしてある。昇降機構７には、スイッチ１０を介設した放電回路１６が接続してあり、一端がアース１２に接続してある。

【００２２】前記リフトピン５は、図２に示したような構造で長さ方向で伸縮可能としてある。即ち、昇降機構７に植設される基部側が筒体２４で構成され、筒体２４内に装着したバネ２５で弾持したボルト状の杆体２３の先端部が筒体２４から突出させてある。そしてこの杆体２３の先端に円柱状に形成したカーボン製の抵抗部材２１が螺着してあり、押えナット２２で固定してある。図中２６は筒体２４の基部に螺着したバネ押えである。バネ２５は、冷却機構４と昇降機構７の間に装着したバネ８に比べて弾力の弱いバネとしてある。

【００２３】次に上記実施例で、処理基板を脱着する方法について説明する。

【００２４】処理基板１をプラズマ処理する場合は、図１(a) に示したように昇降機構７はバネ８の弾力で降下した状態とし、リフトピン５の先端部が絶縁物２の孔１４内に収容されるようにする。回路１３のスイッチ９を閉じて、処理基板１と電極３の間に電圧を印加すると、処理基板１と電極３の間に電荷が蓄積される結果、処理基板１は絶縁物２の表面に静電吸着される。従って処理基板１は絶縁物２を介して冷却機構４によって充分に冷却されることになる。尚、この場合、放電回路１６のスイッチ１０は開の状態とする。

【００２５】プラズマ処理が終了し、処理基板１を他の場所へ搬送する時には、(b) のように回路１３のスイッチ９を開とする一方、放電回路１６のスイッチ１０を閉とし、かつリフトピン５、５の先端部を絶縁物２から突出させるべく、昇降機構７をバネ８の弾力に抗して上昇させる。

【００２６】この時、処理基板１と電極３の間には、未だ電荷が残っており、静電吸着の状態にあるので、リフトピン５は、その上昇に従ってバネ２５が縮み、杆体２３が筒体２４内に没入し、図１(b) に示したような状態で、抵抗部材２１が処理基板１に当接した初期状態が一時的に保持される。

【００２７】リフトピン５の抵抗部材２１が処理基板１に当接すると、処理基板１と電極３の間に残っていた電荷が抵抗部材２１および放電回路１６を通してアース１２側へ放電される。この放電々流は抵抗部材２１を通して流れるので、電流が制限され、処理基板１内の回路への急激な電流の放電によるダメージを避けることができる。抵抗部材２１は杆体２３に螺着、固定してあり、交換可能としてあるので、許容される放電々流を考慮して、放電時間が最短にできるような抵抗値の抵抗部材２１を選定する。

5

【００２８】抵抗部材２１および放電回路１６を通して放電が進行すると、処理基板１と電極３の間の静電吸着力が弱くなり、リフトピン５内のバネ２４の弾力が静電吸着の力に打勝つようになると、リフトピン５が伸長して(c) に示したように、処理基板１を絶縁物２から持上げる。これで静電チャックの開放が終了するので、放電回路１６のスイッチを開とすると共に、処理基板１は、搬送ロボット（図示していない）などによって、次の工程へ搬送すれば良い。

【００２９】前記実施例におけるスイッチ９は、リアクティブイオンエッチング装置においては、プラズマの生成又は消滅がスイッチとしての働きをするので、電気回路としてのスイッチ９は設けなくても良い。

【００３０】

【発明の効果】以上に説明したように、この発明によれば、静電吸着の為の電荷を、リフトピンを介して電流制限しながら放電させた後、吸着面から持上げるようにしたので、処理基板への放電々流によるダメージおよび処理基板の破損を防止できる効果がある。

6

＊【図面の簡単な説明】

【図１】この発明の実施例の断面図であり、(a) は静電吸着時、(b) は電荷放電時、(c) は処理基板を持上げた時を夫々示している。

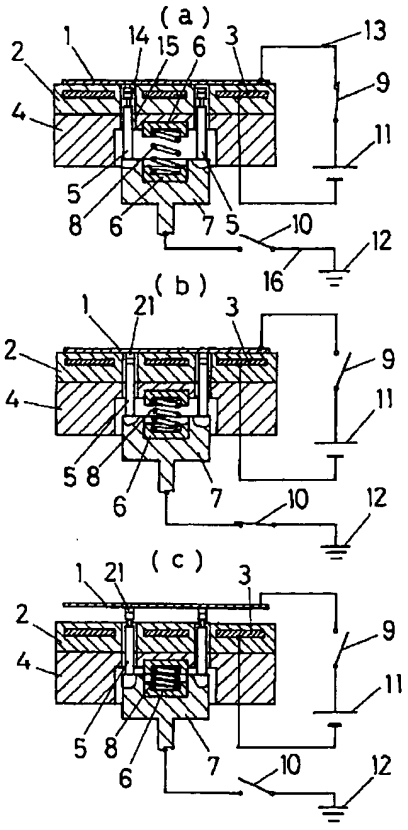
【図２】同じく実施例のリフトピンの拡大断面図である。

【図３】従来の静電チャック装置の断面図である。

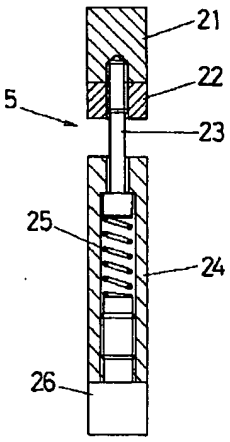
【符号の説明】

１　処理基板
２　絶縁物
３　電極
４　冷却機構
５　リフトピン
７　昇降機構
８　バネ
２１　抵抗部材
２３　杆体
２５　バネ

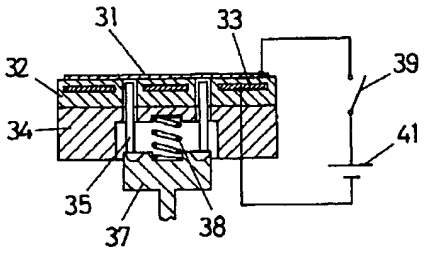
【図１】



【図２】



【図３】



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-007072
(43)Date of publication of application : 10.01.1995

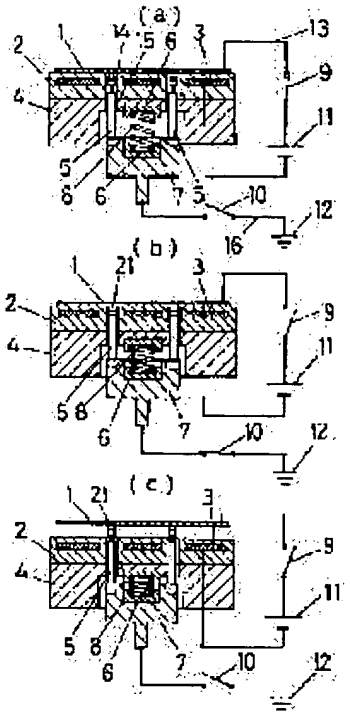
(51)Int.CI. H01L 21/68
B23Q 3/15
C23C 14/50
H02N 13/00

(21)Application number : 05-146487
(22)Date of filing : 17.06.1993

(71)Applicant : ANELVA CORP
(72)Inventor : DOI HIROSHI

(54) METHOD AND MECHANISM FOR UNLOADING SUBSTRATE IN ELECTROSTATIC CHUCK DEVICE

(57)Abstract:
PURPOSE: To provide a substrate unloading method and mechanism by which substrates to be processed are not broken and circuits in the substrates are not damaged for an electrostatic chuck device used in devices which process substrates such as semiconductor wafers with plasma.
CONSTITUTION: In a substrate unloading mechanism for electrostatic chuck devices in which lift pins 5 are provided so that the pins 5 can be protruded from the attracting surface of an electrostatic chuck, resistance members 21 are installed to the front ends of the pins 5 and the pins 5 are constituted so that they can be elongated and contracted in their length directions. Upon unloading a processed substrate 1, the pins 5 are raised until their front ends come into contact with the rear surface of the substrate 1 and the static electricity on the attracting surface of the electrostatic chuck is discharged through the members 21 while the initial contacting state is maintained between the substrate 1 and pins 5. After discharging, the substrate 1 is unloaded from the attracting surface of the electrostatic chuck by further raising the pins 5.



LEGAL STATUS

[Date of request for examination]	08.06.2000
[Date of sending the examiner's decision of rejection]	16.07.2002
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2002-15523
[Date of requesting appeal against examiner's decision of rejection]	14.08.2002
[Date of extinction of right]	

h c g e e h

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the approach of carrying out desorption of the substrate which stuck to the electrostatic chuck through a rise of a lift pin Raise a lift pin and the rear face of a substrate is contacted in the tip of a lift pin. The desorption approach of the substrate in the electrostatic chuck equipment characterized by keeping a contact initial state temporary, making it discharge through the resistance member which interposed static electricity of an adsorption sid in the lift pin, re-raising an appropriate back lift pin, and carrying out desorption of the substrate from an adsorption side.
[Claim 2] Said lift pin is the substrate desorption device of the electrostatic chuck equipment characterized by having made telescopic motion possible in the die-length direction while having interposed the resistance member in the substrate desorption device of electrostatic chuck equipment in which it comes to prepare a lift pin in the adsorption side of an electrostatic chuck possible [a protrusion].
[Claim 3] A lift pin is the substrate desorption device of the electrostatic chuck equipment according to claim 2 whic ****(ed) the rod cell through the spring to the tip side, and prepared and constituted the resistance member at the tip this rod cell.
[Claim 4] A resistance member is a substrate desorption device of electrostatic chuck equipment according to claim prepared in the rod cell removable.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the electrostatic chuck equipment which constitutes the substrate supporter of a dry etching system, a sputtering system, plasma-CVD equipment, and other plasma treatment equipments, and relates to the desorption approach of the substrate which stuck to electrostatic chuck equipment, and desorption device.
[0002]
[Description of the Prior Art] Conventionally, the dry etching method, the sputtering method, the plasma-CVD meth etc. are learned as a technique of processing substrates, such as a semi-conductor wafer, using the plasma.
[0003] Since the temperature of the substrate exposed to the plasma rises before and after 200 degrees C when processing a substrate with these techniques, generally it supported with the substrate electrode holder cooled with th refrigerant of water and others, and has prevented heating a substrate.
[0004] In order to acquire the cooling effect certainly, said substrate electrode holder and substrate needed to make t thermal conductivity between both high, and had a method of carrying out the pressure welding of the substrate to a substrate electrode holder by the clamp, but since a clamp part (edge of a substrate) is excepted from processing and deployment of a substrate is barred, electrostatic chuck equipment as shown in drawing 3 has come to be used widely
[0005] The electrostatic chuck equipment shown in drawing 3 constitutes the substrate electrode holder which suppo the processing substrate 31, and the electrode 33 covered with the insulating material 32 (it is hundreds of microns in thickness in fact although shown with thickness also including the following examples.) is formed on the cooler style 34. If the potential difference is given between the processing substrate 31 and an electrode 33, a charge will be accumulated between the processing substrate 31 and an electrode 33 by the direct current circuit which has a switch and DC power supply 41 (1-2Kv), and electrostatic adsorption power will be acquired. In addition, like [in the case reactive-ion-etching equipment], with the direct current voltage impressed to the plasma potential and the electrode under plasma treatment, as the potential difference arises between the processing substrate 31 and an electrode 33, sa direct current circuit may not use it.
[0006] This cooler style, an insulating material 32, and an electrode 33 are penetrated, the lift pins 35 and 35 which enabled it to project in the processing substrate 31 side prepare in said cooler style 34 side through the elevator style 37, and the desorption device of a substrate is constituted. Between the elevator style 37 and the cooler style 34, he h installed the spring 38, and is trying, as for the lift pins 35 and 35, to absorb a point in an insulating material 32.
[0007] If the lift pins 35 and 35 are made to project to the processing substrate 31 side across a substrate adsorption side through the elevator style 37 when predetermined plasma treatment is completed The lift pins 35 and 35 contact the processing substrate 31, the charge accumulated between the processing substrate 31 and the electrode 33 at the time of an electrostatic chuck is made to discharge to a ground side through the lift pins 35 and 35, electrostatic adsorption power is canceled, and the processing substrate 31 is lifted from an insulating material 32.
[0008]
[Problem(s) to be Solved by the Invention] In the above electrostatic chuck equipments, the lift pins 35 and 35 were made to project, and when desorption of the processing substrate 31 was lifted and carried out, there were the follow troubles.
[0009] That is, in above electrostatic chuck equipment, although it was a **** short time by the time the charge accumulated between the processing substrate 31 and the electrode 33 discharged and electrostatic adsorption power was lost, after the lift pins 35 and 35 contacted the processing substrate, a certain time amount was required. Howeve since ** et al. and the lift pins 35 and 35 were the structures where it went up without stopping at the location which

h c g cg b eb cg e e

contacted the processing substrate 31, although electrostatic adsorption power still remained, the processing substrat 31 will be lifted, the force with the processing substrate 31 impossible for when electrostatic remaining adsorption power is large was applied, the processing substrate 31 was made to jump out, and there was also a possibility of damaging.

[0010] Moreover, since there was nothing that restricts a current value, it is unrestricted, a discharge current will flow rapidly through the lift pin 35 which contacted the processing substrate 31 first in the circuit which discharges the charge accumulated between said processing substrates 31 and electrodes 33 to a ground side through the lift pins 35 and 35, and there was a possibility may give a damage to the circuit (as a semiconductor device) which this is the cau and formed in the processing substrate 31 in it.

[0011] This invention was made in view of such a trouble, and it aims at offering the desorption approach of a substr and desorption device in the electrostatic chuck equipment it was made not to give a damage to the circuit in a processing substrate while it abolishes a possibility of damaging a processing substrate.

[0012]

[Means for Solving the Problem] The desorption approach of the substrate in the electrostatic chuck equipment of th invention that attains the above-mentioned purpose In the approach of carrying out desorption of the substrate which stuck to the electrostatic chuck through a rise of a lift pin It is characterized by raising a lift pin, contacting the rear f of a substrate in the tip of a lift pin, keeping a contact initial state temporary, making it discharge through the resistan member which interposed static electricity of an adsorption side in the lift pin, re-raising an appropriate back lift pin, and carrying out desorption of the substrate from an adsorption side.

[0013] Moreover, in the substrate desorption device of electrostatic chuck equipment in which the desorption device the substrate in the electrostatic chuck equipment of this invention comes to prepare a lift pin in the adsorption side o an electrostatic chuck possible [a protrusion], said lift pin is characterized by having made telescopic motion possib in the die-length direction while having interposed the resistance member.

[0014] Said lift pin **** a rod cell through a spring for example, to a tip side, and prepares and constitutes a resistan member at the tip of this rod cell. As for a resistance member, preparing removable to a rod cell is desirable.

[0015]

[Function] Static electricity of the adsorption section can be made to discharge, without pushing up the substrate to which it stuck by force, since the initial state which made the tip of a lift pin contact the rear face of a substrate is kep temporary according to this invention. Therefore, the elutriation of a substrate and breakage can be lost.

[0016] Moreover, since discharge of static electricity is performed through the resistance member interposed in a lift pin, a discharge current is restricted and it can avoid giving damages, such as destruction of the circuit in the substrat by the rapid discharge current.

[0017] When said resistance member is constituted removable, the resistance of a discharge circuit can be changed a a discharge current can be set up in consideration of the structure of a processing substrate etc.

[0018]

[Example] Hereafter, the example of this invention is explained with reference to drawing.

[0019] It sets to drawing 1 and is (a). The condition that the electrostatic chuck equipment of an example is carrying electrostatic adsorption of the processing substrate 1, and (b) The condition and (c) which are discharging the charge which the lift pin 5 was raised and was accumulated between the processing substrate 1 and the electrode 3 The condition of having lifted the processing substrate 1 by the lift pin 5 is expressed, respectively.

[0020] The electrode 3 covered with the insulating material 2 like the conventional equipment shown in drawing 3 carries the electrostatic chuck equipment of an example in the cooler style 4, it is constituted, and a switch 9 and DC power supply 11 constitute the circuit 13 for impressing direct current voltage between the processing substrate 1 an an electrode 3.

[0021] The lift pins 5 and 5 which the hole 14 formed so that an insulating material 2 and an electrode 3 might be penetrated, and the hole 15 formed so that the cooler style 4 might be penetrated made have opened each other for fr passage, and inserted in these holes 14 and 15 implant in the elevator style 7 installed in the lower part of the cooler style 4, and the desorption device of a substrate is constituted. Between the elevator style 7 and the cooler style 4, it h equipped with the spring 8 through the spring receptacles 6 and 6 made from an insulating material, and as for the lif pins 5 and 5, it is always located by the amount of point in an insulating material 2, and is made to have not projecte to the insulating material 2 up side for the elasticity of a spring 8. The discharge circuit 16 which interposed the swit 10 is connected to the elevator style 7, and the end is connected to the ground 12.

[0022] Telescopic motion of said lift pin 5 is enabled in the die-length direction by structure as shown in drawing 2 . That is, the base side implanted in the elevator style 7 consists of barrels 24, and the point of the rod cell 23 of the

shape of a bolt which ****(ed) with the spring 25 with which it equipped in the barrel 24 makes it have projected fro the barrel 24. And the resistance member 21 made from carbon formed in the shape of a cylinder is screwed on at the tip of this rod cell 23, and it has fixed with the presser-foot nut 22. 26 in drawing is the spring presser foot screwed o the base of a barrel 24. The spring 25 is used as the weak spring of elasticity compared with the spring 8 with which equipped between the cooler style 4 and the elevator style 7.

[0023] Next, the above-mentioned example explains how to carry out desorption of the processing substrate.

[0024] When carrying out plasma treatment of the processing substrate 1, it is drawing 1 R> 1 (a). As shown, the elevator style 7 considers as the condition of having descended for the elasticity of a spring 8, and the point of the lif pin 5 is held in the hole 14 of an insulating material 2. If the switch 9 of a circuit 13 is closed and an electrical potent difference is impressed between the processing substrate 1 and an electrode 3, as a result of accumulating a charge between the processing substrate 1 and an electrode 3, electrostatic adsorption of the processing substrate 1 is carried out on the front face of an insulating material 2. Therefore, the processing substrate 1 will fully be cooled by the coo style 4 through an insulating material 2. In addition, the switch 10 of the discharge circuit 16 is made into an open condition in this case.

[0025] It is (b), when plasma treatment is completed and the processing substrate 1 is conveyed to other locations. While making the switch 9 of a circuit 13 open like, the elasticity of a spring 8 is resisted and the elevator style 7 is raised in order to make the switch 10 of the discharge circuit 16 close and to make the point of the lift pins 5 and 5 project from an insulating material 2.

[0026] Since the charge still remains between the processing substrate 1 and the electrode 3 and it is in the condition electrostatic adsorption at this time, a spring 25 is shrunken according to that rise, a rod cell 23 is absorbed in a barre 24, and the lift pin 5 is drawing 1 (b). It is in a condition as shown and the initial state to which the resistance membe 21 contacted the processing substrate 1 is held temporarily.

[0027] If the resistance member 21 of the lift pin 5 contacts the processing substrate 1, the charge which remained between the processing substrate 1 and the electrode 3 will discharge to a ground 12 side through the resistance member 21 and the discharge circuit 16. Since this discharge current flows through the resistance member 21, a curre is restricted and the damage by discharge of the rapid current to the circuit in the processing substrate 1 can be avoid Since the resistance member 21 is screwed on and fixed to the rod cell 23 and it is exchangeable, in consideration of discharge current permitted, the resistance member 21 of resistance as for which a charging time value is made to the shortest is selected.

[0028] When the electrostatic adsorption power between the processing substrate 1 and an electrode 3 will become weak if discharge advances through the resistance member 21 and the discharge circuit 16, and the elasticity of the spring 24 in the lift pin 5 comes to overcome the force of electrostatic adsorption, the lift pin 5 develops and it is (c). As shown, the processing substrate 1 is lifted from an insulating material 2. What is necessary is just to convey the processing substrate 1 to the following process with a carrier robot (not shown) etc., while making the switch of the discharge circuit 16 open, since disconnection of an electrostatic chuck is completed now.

[0029] In reactive-ion-etching equipment, since generation or disappearance of the plasma carries out the work as a switch, the switch 9 in said example does not need to form the switch 9 as an electrical circuit.

[0030]

[Effect of the Invention] Since it was made to raise from an adsorption side according to this invention as explained above after making it discharge, carrying out current limiting of the charge for electrostatic adsorption through a lift pin, it is effective in the ability to prevent breakage of the damage by the discharge current to a processing substrate, and a processing substrate.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view of the example of this invention, and is (a). It is (b) at the time of electrostatic adsorption. It is (c) at the time of charge discharge. The time of lifting a processing substrate is shown, respectively.
[Drawing 2] Similarly it is the expanded sectional view of the lift pin of an example.
[Drawing 3] It is the sectional view of conventional electrostatic chuck equipment.
[Description of Notations]
1 Processing Substrate
2 Insulating Material
3 Electrode
4 Cooler Style
5 Lift Pin
7 Elevator Style
8 Spring
21 Resistance Member
23 ** ** Object
25 Spring

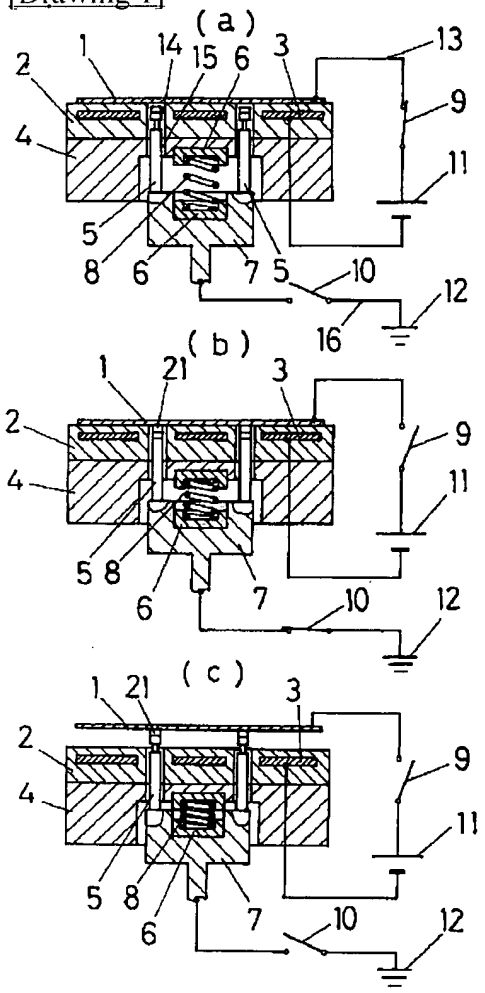
[Translation done.]

* NOTICES *

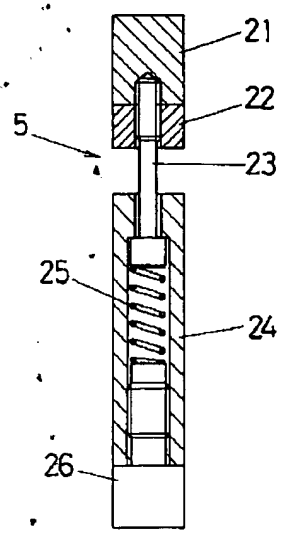
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

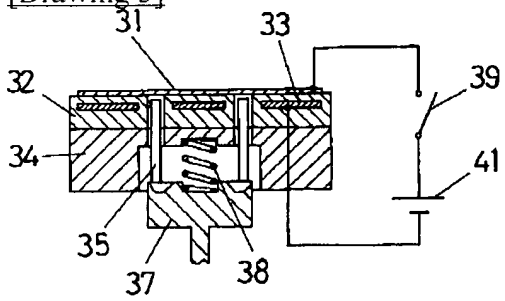
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]